CALIFORNIA DIVISION OF MINES AND GEOLOGY
FAULT EVALUATION REPORT FER-181
SUPPLEMENT NO. 1
NORTHWEST EXTENSION OF MESQUITE LAKE FAULT,
SAN BERNARDINO COUNTY, CALIFORNIA

by
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The Mesquite Lake fault was previously evaluated by Bryant (1986), who recommended zoning under the Alquist-Priolo Special Studies Zones Act. However, his evaluation and zone recommendations did not extend north of the Twentynine Palms 7.5' quadrangle, where the fault was identified as active. New information has been made available since then that suggests that the Mesquite Lake fault may be active in the Deadman Lake SE 7.5' quadrangle, immediately north of Bryant's study area. The new information is provided by Rasmussen (1983), Moyle (1984), and Akers (1986).

SUMMARY OF AVAILABLE DATA

Prior to 1983, the only detailed mapping that suggested the Mesquite Lake fault extended northwest of the Twentynine Palms quadrangle was by Dibblee (1967). Dibblee shows the trace to be concealed by Holocene and/or late Pleistocene alluvium, but provides no documentation for inferring the location. His trace is plotted on Figure 1 (purple).

Morton and others (1980) mapped several, short discontinuous faults in older alluvium southwest of Dibblee's concealed trace (fig. 1). They provide no direct evidence of Holocene activity and state that some of the traces may be "lithologically controlled" (i.e. erosional features).

Subsequent work by Rasmussen and Associates (1983) showed the Mesquite Lake fault as a surface feature (partly projected), which is plotted in green on Fig. 1. According to Rasmussen, the fault was observed on aerial photographs to offset Holocene deposits (they do not state where), but the activity decreases northwestward past Deadman Lake and eventually dies out at Gypsum Ridge (about 10 km beyond the Deadman Lake SE quadrangle). The firm trenched the fault in sec. 11 (trenches 4, 5 and 6 on Fig. 1), exposing a zone of distributive faulting more than 100 m wide. The faults offset Pleistocene alluvium, trended northwest and dipped moderately to steeply northeast (northeast-side down), but reportedly did not offset the overlying Holocene deposits. It is noted that these trenches appear to be mislocated about 130 m too far to the south. Another trench (T-3) was located just north of the fault near the west boundary of sec. 11 (Fig. 1), but no faulting or deformation was observed in deposits of Pleistocene age. The other traces shown by Rasmussen and Associates (Fig. 1) were not trenched.

Moyle (1984) and Akers (1986) both show the Mesquite Lake fault to extend northward along the east side of Deadman Lake (Fig. 1) where it is inferred to be a groundwater barrier in alluvium. The barrier location apparently is based on two water wells -- A1 and B1 -- that showed the water level in 1952 to be at depths of 35.5 and 95.2 feet, respectively. Calculations indicate about a 73-foot difference in water level exists (higher on the east). It is noted, however, that these wells are nearly 3 km apart and that there is no surface evidence for faulting where they locate the inferred groundwater barrier.

INTERPRETATION OF AERIAL PHOTOGRAPHS

U.S. Department of Agriculture photos (USDA, 1952 and 1953) were carefully interpreted in order to check the mapped faults of other workers and to map other recently active faults that may exist. Comments on the work of others appear on Fig. 1. The interpretations of geomorphic and tonal features suggestive of the location and/or recency of faulting are plotted on Fig. 2. None of the faults of features identified on Figures 1 and 2 were field-checked.

The only evidence of a continuous, recently active fault is the 1.5-km-long trace that extends southwestward from north-central part of sec. 13 to the quadrangle boundary. This trace is well-defined. The scarps in older alluvium clearly indicate late Quaternary activity. The tonal features in alluvium and right-laterally deflected drainages suggest Holocene or latest Pleistocene right slip along this segment. Features to the northwest are spread over a wide zone and indicate that faulting is distributive. The projection of these traces towards Deadman Lake suggests that the mapped features are minor faults related to downwarping of the large depression. However, no single trace dominates this graben, which reportedly is filled with 3 km of sediment over crystalline basement (Moyle, 1984).

Based on my mapping, it would appear that the Mesquite Lake fault northwest of sec. 13 is a zone at least one kilometer wide and poorly defined. Although some faults in the zone may be Holocene-active, many of the scarps in the older Pleistocene deposits along the southwest margin of the zone appear to be due to differential erosion.

CONCLUSIONS

The northwestern extension of the Mesquite Lake fault in the Deadman Lake SE quadrangle is largely a wide zone of faults associated with the Deadman Lake depression. Although the fault aligns with the West Calico fault to the northwest, it does not connect with it at the surface. Instead, it probably connects as a right step across Deadman Lake with the active Bullion fault zone (see Hart, 1987). It is moderately well-defined southeast of section 13, where it connects to the south with the well-defined Holocene fault mapped by Bryant (1986). Right-laterally deflected drainages and other features indicate that the fault has had dominant right-slip in Holocene time at least as far northwest as sec. 13. Northwest of there, the fault splays into a wide zone of oblique slip faults (large normal component), none of which can be mapped as a continuous surface feature. Its subsurface position, however, may be approximately indicated by the inferred groundwater barrier that projects toward Deadman Lake.

RECOMMENDATIONS

It is recommended that only the well-defined trace of the Mesquite Lake fault be zoned in sec. 13 and southeastward (highlighted in yellow, fig. 2). That strand is active to the south in the Twentynine Palms quadrangle (Bryant, 1986) and is marginally active in the Deadman Lake SE quadrangle. Zoning also could be extended northwest through sec. 12, but zoning is not recommended for the remainder of the fault to the northwest of section 12.

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